

FLORISTIC STUDIES IN INDIA—THE WESTERN CIRCLE

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INTRODUCTION

The Western Circle of the Botanical Survey of India, Pune, established in December, 1955, covered the States of Rajasthan, Gujarat, Maharashtra, Mysore (Karnataka), Kerala and parts of Madhya Pradesh besides the Laccadives and Minicoy groups of islands. With the liberation of the Portuguese enclaves of Goa, Daman, Diu and Nagarhaveli in December, 1960, these were also included. All these exhibit diverse types of vegetation ranging from the arid tracts in the north to the richly luxuriant evergreen forests in the south. Consequent on establishment of new Circles at Allahabad, in 1962 and more recently at Jodhpur in 1977, readjustment of areas for exploration became necessary. The Western Circle now comprises of the States of Maharashtra and Karnataka besides the centrally administered territories of Goa, as well as the Laccadive and Minicoy group of islands.

During the early phase of the Circle, Puri, Jain and R. S. Rao undertook explorations with the primary aim of accumulating authentic firsthand floristic data for the region. These early explorations enabled a proper planning of future exploration programmes on a rational and scientific basis. As a result, under-explored or unexplored regions as well as selected floristically rich or taxonomically interesting areas were accorded priority for phased intensive studies. The explorations also added to our knowledge of the rare,

relict or endangered plants. The results of the explorations both historic as well as recent, have been discussed below :

HISTORICAL AND RECENT ACCOUNTS OF EXPLORATIONS

1. RAJASTHAN

Blatter and Hallberg (1918-21) were the first to focus attention on the flora of the Indian deserts, chiefly on regions around Jaisalmer and Jodhpur. During the years 1951-58, Shanti Sarup and his students had worked on the botanical aspects of Jodhpur, Jaipur, Jaisalmer, Bikaner and neighbouring areas while Bhandari was concentrating on the North West Indian desert.

Since the inception of the Western Circle, many extensive explorations and ecological studies have been undertaken by workers from this Circle, notable amongst them being Puri and Jain. They had also studied the grasslands in Rajasthan in detail. Based on their collections the "Flora of Rajasthan—West of the Aravallis" has been published in the records of the Botanical Survey of India by Puri *et al* (1964) enumerating nearly 750 species under 90 families and 410 genera. Rao and Kanodia (1962, 1963) made intensive studies in the Jodhpur division and also have published on the grasses of Mt. Abu (1965) before those areas were excluded from this Circle. Kanodia has also explored the

Banswada district, besides critically studying the flora of Jodhpur and Udaipur divisions.

II. GUJARAT

The credit for the first work on systematic Botany written in a regional language (Gujarati) goes to J. Indrajī Thakar who had written an account of Barda hills in 1910. Along with Gokuldas Bhandari, he published in Gujarati on the medicinal and economic plants of Kutch and Saurashtra. Blatter (1908-09) had worked on the Flora of Kutch while Saxton and Sedgwick (1918) published the "Flora of North Gujarat". Since 1947, thanks to the Blatter Herbarium at St. Xavier's College, Bombay, there has been a renewed interest in taxonomy and floristics. Under the auspices of the Saurashtra Research Society, Rajkot and Gujarat Research Society, Bombay, Santapau and his students have botanically explored Saurashtra and Dangs district resulting in the publications "Plants of Saurashtra—a preliminary list (1953)" and "Contribution to the Botany of Dangs forest in Bombay State (1955)". Recently a band of workers from the different Universities in Gujarat have been actively engaged in compiling regional floras. Notable amongst them include, S. J. Bedi, A. R. Chavan, J. A. Inamdar, G. M. Oza, S. D. Sabnis, C. K. Shah, G. L. Shah, D. N. Thakar, and D. V. Yogi. Under their guidance, as part of doctoral dissertations, research workers have taken up the floras of Baroda, Broach, Bulsar, Dangs, Dharampur, Kaprada, Khedbrahma, Parnera hills, Pavagadh, Rander, Ratanmahal, Rajpipla, Tiskari, Tuwa, Visnagar, Vyara etc. adding valuable data to our knowledge on the floras of North, Central and South Gujarat. Sabnis (1962), Shah *et al* (1974) and Parabia and Shah (1975) have worked out the Cyperaceae of Gujarat, describing some rare interesting new records. Patel (1965) as also Naithani and Raizada

(1977) have studied Poaceae and its distributional records. Of the recently published floras, mention may be made of the "Flora of Pavagadh (Gujarat State) India" (Chavan and Oza, 1966) and "The Flora of Ahmedabad" (Vaidya, 1967).

The vegetation of Dangs district has been dealt with in detail by Jain (1963) and Kutch district has received good attention at the hands of various workers from this Circle. Some of the aspects dealt with include the vegetation and succession of plant communities in Kutch (Jain, 1968), distribution pattern of plants in Kutch Flora (Puri *et al*, 1960), additions to the flora of Kutch (Jain and Deshpande, 1960; Jain and Kanodia, 1960) and studies in the flora of Kutch in relation to their utility in the economic development of the arid regions (R. S. Rao, 1970). Based on the earlier available data as well as recent fresh collections by Jain, R. S. Rao, Raghavan and Wadhwa, the Flora of Kutch is jointly under preparation. Ansari and R. S. Rao (1967) have also studied the grasslands of Gujarat State. The Flora of Jamnagar district has been worked out by Malhotra and Wadhwa (1971). Santapau and Janardhanan (1966) have brought out upto-date checklist of the Flora of Saurashtra. T. A. Rao and his associates (1963; 1966-1968) have carried out ecological studies of the Saurashtra coast including the neighbouring islands, classified the vegetation along the coastal belt and also recorded many interesting and rare plants. Hemadri (1968) too has published many new plant records for Gujarat. Based on collections deposited at BSI as well as from various published data, the State Flora analysis of Gujarat State is being compiled enumerating over 1,800 species.

III. MAHARASHTRA

(a) *Brief historic account* : Some of the

prominent earliest explorers from Western India include Law, Graham, Nimmo, Sykes, Jacquemont, Gibson, Dalzell, Birdwood, Nairne, Hallberg. Acland, Cooke, Woodrow, and Ryan to mention a few. Graham's catalogue of the Bombay plants (1837) was followed by Dalzell and Gibson's *Flora of Bombay* (1861) and Nairne's "Flowering Plants of Western India" (1894). Woodrow (1897-1901) published many papers on the *Flora of Western India* and Birdwood (1896-1897) enumerated plants from Matheran and Mahabaleshwar. Lisboa (1890-93) published a list of Bombay grasses. In building up the herbarium Cooke, Woodrow and Gammie were ably assisted by Indian botanists like Kanitkar, Ranade, Bhide, Patwardhan, Paranjpye, Barns, Narayana, Godbole, Bhiva and Garade. Though Cooke himself had made only random collections from Bombay Presidency, on the basis of collections and literature available, he published "The Flora of Bombay Presidency" (1901-08) embracing regions from Sind to North Kanara. Blatter and McCann during the years 1926-35 published a series of papers on Bombay Flora dealing with accounts of many families and described many new taxa from the Sahyadri ranges adding to our knowledge of the Bombay Flora. They also published a monograph of the Bombay grasses in 1935.

(b) *Research carried out at the Blatter Herbarium and other Institutions*: Thanks to the efforts of Santapau, interest in taxonomy and floristics was revived and recognition accorded to taxonomy by the different Universities in the country. During the years 1944-1969 he has published numerous papers dealing with varied aspects such as history of botany, herbarium techniques, enumeration accounts of botanical trips, nomenclatural notes, local floras, additions to the flora, new taxa and plant records and revision of families or genera on a regional basis, some of them

with his students. Bole (1970) has given details of the important scientific publications by Fr. Santapau. From St. Xavier's College, apart from Santapau, mention may be made of Bole and Irani who have worked out the floras of Mahabaleshwar and Matheran respectively which are yet to be published. Randeria (1960) has revised the genus *Blumea* DC. while Saldanha (1963, 1966) has critically studied the genera *Striga* Lour. and *Torenia* L. in Western India. Recently Almeida (1969, 1972) has described some new species of *Arthraxon*, *Dimeria* and *Ischaemum*.

Vartak has contributed towards a better understanding especially of the floras of Poona and Satara, and in some areas of Colaba and Ahmednagar districts. His publications also deal with noteworthy, rare, interesting or imperfectly known plants, promising wild horticultural, medicinal or edible plants of interest, additions to the flora of some districts and new records for Maharashtra. He has also dealt with the Cyperaceae (Vartak, 1966; Datar & Vartak, 1976), Podostemaceae (Vartak & Bhadbhade, 1973) and Eriocaulaceae (in press) of Maharashtra, as also Caesalpiniaceae of India. Of late he has been devoting his attention to ethnobotany and study of the flora of sacred groves. Also from Pune, Karnik (1961) as well Mahabale and Karnik (1960) have studied the Flora and vegetation of Satpura mountains (Kandesh district) and Dabhade (1966) the Flora of Ulhasnagar. Birari and D'Cruz (1976) from Pune Agriculture College have described a new species of *Pseudanthistiria* from Maharashtra. Patel and D'Cruz (1972) have published on the abundance of *Ischaemum mangaluricum* (Hack.) Stapf ex Fischer in Maharashtra. Since 1968, Naik from Marathwada University has been concentrating on the floras of Aurangabad and Osmanabad districts, describing a few new species in Fabaceae and Poaceae, besides many new

records for Marathwada. He has also published two booklets viz. "Herbarium (an enumeration of vascular plants), Marathwada University, Aurangabad (1974)" and "Key to the Angiospermic families and certain genera of Marathwada (1977)" being precursors towards the Flora of Marathwada. In addition he has carried out cytotaxonomic studies in *Urginea*, *Dipcadi* and *Chlorophytum* (Liliaceae).

From Nagpur University, Mirashi and his team have carried out studies in Asteraceae, Cyperaceae and Tubiflorae of Nagpur besides publishing a few new records for the district. Dande (1966) has published on the Cyperaceae of Nagpur. Deshpande, B. D. and M. B. Deshpande (1963) have worked out the Flora of Chandmari hillocks (Wardha) and Balapure (1971) has published some additions to the flora of Ramtek, near Nagpur. From Shivaji University, Mahajan and his associates (1968, 1969) have published a few papers on the Flora of Kolhapur. The Flora of Melghat in Amravathi district has been recently published by Patel (1968). Bharucha and Shankarnarayan (1958) as well as Satyanarayan (1958, 1959, 1961) have carried out ecological studies on the grasslands, coastline strand vegetation and evergreen forests of Maharashtra.

(c) *Research work carried out by the staff of the Botanical Survey of India since 1956* : During the years 1956-60, the explorations in Maharashtra were of a general nature dealing with the ecology and vegetation of Pune district (Puri and Jain, 1959 and 1960; Puri and Patil, 1960), Konkan (Jain, 1959), Khandesh (Jain and Deshpande, 1964), Mahabaleshwar (Puri and Mahajan, 1960) etc. besides floristic studies on the mangrove vegetation of Western India (Patil, 1957; Puri and Jain, 1957), and other miscellaneous short communications. It was apparent that

the Sahyadri ranges had been explored only in patches and much yet remained to be done. Many of the new taxa described by Blatter, McCann, Hallberg and Dalzell could not be rediscovered, the types or authentic specimens were either poor or often not represented in any herbaria and their taxonomic status was uncertain. Against the above background on priority concentrated efforts for floristic surveys were directed towards selected floristically rich areas and areas where the flora was in danger of being drastically altered due to developmental projects. Within Poona district itself there existed many such pockets as Bhimashankar, Junnar, Sakarpathar, Ambavane and Sinhagad.

Janardhanan (1966) exploring Bhimashankar and surrounding areas during 1960-63, enumerated 838 species. Venkata Reddi (1969, 1970) with Lonavla as base camp trekked through the difficult terrains of Sakarpathar and Ambavane during 1962-65 listing 850 species. Junnar, the type locality of species of *Delphinium malabaricum* (Huth) Munz, *Senecio hewrensis* (Dalz.) Hook. f., *Frerea indica* Dalz., *Striga sulphurea* Dalz., *Nepeta bombaiensis* Dalz. etc. was still regarded a rich virgin area and Hemadri (1970) exploring these ranges during the years 1964-69 could describe 14 new species thereby emphasising the extent of the yet unknown flora. In all, he had noted 936 species of angiosperms under 550 genera. Besides, the new species, his work revealed many new records for Maharashtra and resulted in a better understanding of many lesser known plants. He also succeeded in the rediscovery of many species after a lapse of 50 or more years. In Poona district, Ansari undertook many short trips to Purandhar and Simhagad, describing new species of *Ceropegia*, *Chlorophytum* and *Urginea*. These, together with Santapau's Flora of Khandala account for the Flora of Pune district nearly 60% of the plants

occurring in the entire State. Short botanical trips were also undertaken to Panchgani and Mahabaleshwar from where many of the new species earlier described by Blatter, Hallberg and McCann could be recollected and in the light of the fresh collections their taxonomic status and affinities with allied species could be clarified. During the last 5-6 years, many new species have been described by Rolla Rao, Ansari, Hemadri and Wadhwa from these ranges.

Chanda district, potentially rich in plant resources that could feed plant based village industries that could contribute to the economic uplift of the tribals, was accorded priority in planning district floras. Malhotra and Moorthy (1974) exploring these forests have listed nearly 800 species. The Taroba wild life sanctuary was systematically analysed by Wadhwa not only from the floristic aspects but also to correlate the flora with the fauna. Pataskar has made extensive collections from Dhulia district. Working on the flora of Thana district, Billore (1972) has enumerated nearly 1,096 species (under 586 genera), discovered 3 new species, reported 15 new records besides an equal number of rare species. Cherian and Pataskar (1969 a, b) have botanised the Surguna-Hursul ranges and Saptashringi and adjoining hills in Nasik district. In Ahmednagar district, representative collections have been made from Pravara-sangam (Subramanyam and R. S. Rao. 1961) and Harishchandragarh (Billore and Hemadri, 1969). An account of the flora of Kolhapur district has been published by Singh *et al* (1972). The Phonda-Ambolighat though forming part of the Sahyadri mountains has an entirely different type of vegetation from Northern Sahyadris and represents the transitional zone of considerable phytogeographic significance. The explorations by Kulkarni during 1968-73, have resulted in an enumeration of 982 species under 525 genera besides

confirming that these ghats represent the starting point of the northern limit of evergreen forests region serving as a connecting link through stages to the dense evergreen forests of Karnataka and Kerala.

As analysis of the regions selected for intensive studies reveals that they represent a transect of the Sahyadri ranges from Peint Surguna in the north (regions with a low rainfall and with a longer period of drought) through Sakarpathar, Khandala and Mahabaleshwar (gradual increase in rainfall but still with a large period of drought) to Phonda-Ambolighat (high rainfall but with considerably shorter period of drought). The vegetation correspondingly varies from the low stunted trees of moist deciduous type at Peint-Surguna through low semi-evergreen canopy at Khandala followed by denser semi-evergreen trees with a sprinkling of a few evergreen species at Mahabaleshwar to the beginning of evergreen forests at Phonda-Ambolighat. It appears that at a given altitude both rainfall as well as the relative period of drought play a significant role in determining the floristic composition, the former more so for drier areas and the latter for humid zones.

R. S. Rao and R. V. Kammathy, during the revision of the Indian genera of Commelinaceae have published many miscellaneous notes on species occurring along Western India, clarifying their systematic position, affinities etc. besides critically analysing the various "species complexes" especially in *Commelina*, *Cyanotis* and *Murdannia*. A revision of the family Capparaceae (Raghavan), selected genera of Poaceae (Miss Deshpande) and the genus *Ceropegia* (Ansari) are in progress. During the years 1965-71 Wadhwa has studied the Moss Flora of the Sahyadri ranges enumerating 288 species from both the Acrocarpic and Pleurocarpic groups and has described 9 new species and one

variety. The collections reveal 30 species of mosses earlier known only from the Himalaya ranges and 20 new distributional records of South Indian mosses.

IV. KARNATAKA (MYSORE STATE)

The earliest records of exploration in Karnataka are by Buchanan-Hamilton, Heyne, Rottler, Klein, Metz, Somersen and Meebold. Of the later botanists, Sedgwick had collected from Dharwar and Talbot from North Kanara. There is no separate flora for Karnataka State as such, but Cooke's "Flora of Bombay" Talbot's "Forest Flora of Bombay Presidency & Sind" and Gamble's "Flora of Madras" cover considerable portions of the State. Though Talbot has published an account of only the trees and shrubs of North Kanara, his herbarium includes the herbaceous species also thereby furnishing a comprehensive idea of the entire flora. Kadambi (1941, 1942, 1945, 1960) has dealt with aspects of evergreen forests of Mysore State enumerating the important shrubs and trees. The Flora of Biligirangan hills has been dealt with by Barnes (1944).

Though the list is by no means, complete some of the floristic works published from the University botanists includes : Flora of Nandi hills (Thirumalachar *et al* 1942, 1949); Vegetation of Ramagiri and neighbourhood (Ramaswamy, 1964), Vegetation of Savandurga (Ramaswamy and Razi, 1967) and Chamundi hills (Raghavendra Rao and Razi, 1973-74). Razi (1946) completed a preliminary list of Mysore plants enumerating 2379 species. The vegetation of Bellary district has been worked out by Satyanarayan and Shankaranarayan (1963, 64). A few papers on selected families confined to Mysore have also been published; Poaceae (Govindu and Thirumalachar, 1952), Cyperaceae (Govindu and Thirumalachar, 1960), Caesalpiniaceae (Pramila and Razi, 1970), Euphorbiaceae (Raghavendra

Rao and Razi, 1970); Polygalaceae (Gnanesundersingh and Razi, 1973-74). The Compositae of Dharwar has been worked out by Ladwa and Patil (1961). New species of *Calamus* L. (Fernandez and Dey, 1970), *Capillipedium* Stapf (Almeida, 1975) and *Marsdenia* R. Br. (Yoganarasimhan and Subramanyam, 1976) have been recently described from Karnataka. However, the first comprehensive work on the Flora of Bangalore district was published in 1973 by Ramaswamy and Razi. Recently Saldanha and Nicolson (1976) have published the Flora of Hassan district enumerating nearly 1700 species. Besides, Yoganarasimhan has worked out Chikmagalur district and Raghavendra Rao and Razi have completed the Flora of Mysore but these are yet to be published.

Since the reorganisation of the Botanical Survey of India, Arora has carried out extensive floristic and ecological studies in the districts of North Kanara (1960, 1961, 1963, 1964, 1966), South Kanara (1965-1967) and Coorg forests (1960, 1964, 1965) dealing with the different forest types, successional trends, floristic composition, vegetational accounts, climatic climax etc. besides publishing a few new records. The deciduous forests of Belgaum and vegetation of Sutgatti have been worked by Ahuja (1962). R. S. Rao and Sastry (1964) enumerated the plants from Devarayanadurga. Exploring Biligirangan hills Kammathy *et al* (1967) have enumerated 825 taxa which also includes many plants reported by Barnes but not recollected by them. A. S. Rao has botanically explored Coorg forests during the years 1960-63. Raghavan (1970) has explored Agumbe and Hulical ranges in Tirthahalli, which due to their distinct topography, pronounced western aspect and high incidence of rainfall have a unique flora. From these forests, besides 47 species of pteridophytes, 1170 species of angiosperms have been collected and 4 new species des-

cribed. In addition, during the years 1969-73, Chikmagalur district has also been explored by Raghavan which includes the Jagar Game sanctuary within Muthodi and Hebbe ranges. While botanising Chikmagalur district, every attempt has been made to study in detail the virgin evergreen forests at Gangamula and Bhagavathi valleys that are undergrowing drastic irreversible changes due to the gigantic Kundremukh Iron Ore Project. At present the flora of South Kanara (Raghavan and Kulkarni) and the drier tracts of Karnataka (Singh) covering 8 districts are in progress. For the first time the Moss flora of Agumbe and Hulical has been worked out enumerating 28 species and two new records for India (Raghavan and Wadhwa, 1968 ; 1970). From the Southern Circle, Naithani (1966) has carried out studies on the Flora of Bandipur reserve forests.

V. UNION TERRITORIES

A. Laccadive and Minicoy Islands : Since Prain's work in 1890 Laccadive and Minicoy group of islands have been explored for the first time by Wadhwa in collaboration with Industrial Section of Indian Museum at Calcutta. During 1959-60, two explorations were undertaken to these group of 19 islands (of which only 10 are inhabited) and 348 species have been collected. The studies reveal that the flora is akin to that of the coral islands of Maldives and Pacific ocean atolls rather than to the Flora of Western Coast. 11 species of Cyperaceae and Poaceae have been recorded as additions to the flora of these islands (Wadhwa, 1961).

B. Goa, Diu, Daman and Nagarhaveli :

(a) *Goa* :—In 1898 Dalgado working on the Flora of Goa and Sawantwadi enumerated 731 wild and 279 cultivated or exotic species. Previously Cooke, Talbot, Kanitker, Bhide and Bhiva have made random collections mostly from Goa. Vartak (1966) enumerated the plants

from 'Gomantak' most of which are distributed in Konkan and his account hardly lists 200 plants from Goa proper. R. S. Rao (1969) exploring these forests (for the first time after liberation from the Portuguese) listed 1115 species. The flora is alike to that of neighbouring North Kanara, with many common species.

(b) *Diu, Daman, Dadra and Nagarhaveli* :—Altogether these regions comprise an area of 587 sq. km only. Prior to 1956, only Bhide had made some passing collections from Dadra and Nagarhaveli. Ecological studies on Diu islands have been carried out by T. A. Rao and Agarwal (1964). 670 species have been enumerated by R. S. Rao (1969) during his explorations. The flora has a close affinity to that of Pavagadh and Saurashtra in Gujarat State.

VI. MISCELLANEOUS

Indore district (Madhya Pradesh) has been explored by A. S. Rao and A. R. K. Sastry (1964) and Tenmalai (Kerala) by K. N. Subramanian, when these areas formed part of the Circle.

CURRENT AND FUTURE PROGRAMMES

With Gujarat forming part of the Arid Zone Circle botanical explorations have been confined to Maharashtra and Karnataka only, efforts being directed to concentrate on those areas that have not received adequate attention. The current projects in hand cover the districts of Amravathi, Akola, Bhandara, Colaba and Yeotmal. Special efforts have been made to study the various wild life sanctuaries in Maharashtra and Karnataka and study the inter-relationship between the flora and the fauna. At present the Dhakna Kolkaz (Amravathi), Nagzira (Bhandara), Kinwat (Yeotmal) game sanctuaries, the Bison sanctuary at Radhanagari (Kolhapur district) and the Karnala bird sanctuary at Kolaba have been taken up for detailed studies. In colla-

boration with the Zoological Survey of India, it is proposed to study the ecological succession at Mahabaleshwar and correlate the flora with the fauna in different seasons. At present the writing of the district floras of Thana, Pune and Chandrapur has been taken up and within two years, the district floras of the other five districts currently in progress will also be completed. Simultaneously, a State Flora analysis of Maharashtra with up-to-date correct nomenclature and indication of the distribution of the various species districtwise, is being prepared. This will facilitate the writing a detailed Flora of Maharashtra State.

In Karnataka, the Mookambika game sanctuary in South Kanara has been chosen for special attention. Part of the rich Kodachadri range forests in this district will be affected due to the Kudremukh Iron Ore Project and hence floristic survey of these ranges is tackled on a priority basis. The exploration aspect of the arid and semi arid tracts of Karnataka comprising of 8 districts has almost been completed and with this most of the districts of Karnataka have been adequately covered facilitating the writing up of the State Flora analysis. The writing up of the flora of Chikmagalur district has already been taken up and by 1979, the flora of South Kanara district will also be completed. At present there is no separate flora for Karnataka as such and concentrated efforts are made to publish the Flora of Karnataka State shortly.

ACHIEVEMENTS

I. *Interesting taxonomic observations* : During the years 1900-1947 nearly 230 taxa have been described from Bombay Presidency as it then comprised and from the limited area of North Kanara alone, Talbot had described 22 new species and Sedgwick 8. Since the publication of Cooke's Flora of Bombay Presidency it is to the credit of Blatter that he, either singly or in association with McCann

or Hallberg, has accounted for 92 new species from the Sahyadri ranges alone. Since 1948, 118 new species have been added to the existing flora of Gujarat, Maharashtra and Karnataka (Appendix I) of which one new genus and 36 new species have been described by botanists from this Circle. These studies, while stressing that the pioneering phase of the exploration is far from over, nevertheless, have shed valuable light to our knowledge of the flora of Western India, helped to rediscover many rare interesting species, recollect many species from the type localities, revealed new areas of distribution and enabled to clarify the taxonomic status and interrelationship between closely allied species. These are briefly summarised below :

Most of the new species described are from Poaceae (*Arthraxon* P. Beauv., *Ischaemum* L., *Manisuris* L., *Isachne* R. Br.), Asclepiadaceae (*Ceropegia* L.), Cyperaceae (*Fimbristylis* Vahl, *Cyperus* L.) and Liliaceae (*Iphigenia* Kunth, *Chlorophytum* Ker-Gawl and *Urginea* Steinh.). In the family Asclepiadaceae, one new genus *Seshagiria* Ansari et Hemadri as well as 8 new species of *Ceropegia* have been described and further the taxonomic status of many species of *Ceropegia* that have been wrongly treated by Huber has been corrected. It has now been conclusively established that species as *C. panchaganiensis* Bl. and McC. (treated under *C. lawii* Hook. f.), *C. vincaefolia* Hook. (included under *C. hirsuta* Wt. and Arn.), *Chlorophytum glaucoides* Blatter (merged under *C. glaucum* Dalz.) to mention a few are taxonomically distinct. As a result of critical studies, some of the newly described species by Blatter, McCann etc. turned out to be mere synonyms but many others were conclusively established to be well defined distinct species which could be successfully collected from the type localities even to-day e.g. *Utricularia equiseticaulis* Blatt. and McC., *U. ogmosperma* Blatt. and

McC., *Urginea polyantha* Blatt. and McC., *Pancratium St. Mariae* Blatt. and Hallb., *Dipcadi ursulae* Blatt. and *Iphigenia stellata* Blatt.

Species which have been considered rare or relict have been rediscovered after a lapse of 50-100 years, some of which have been re-collected for the first time now after the original collections. These include *Aristida stocksii* (Hook. f.) Domin, *Capparis cleghornii* Dunn., *Canscora concanensis* C. B. Cl., *Ceropegia lawii* Hook. f., *Dichanthium maccannii* Blatt., *Dimeria hohenackeri* Hochst. ex Miq., *Eleiotis trifoliata* Cooke, *Euphorbia erythroclada* Boiss., *E. katrajensis* Gage, *Ficus talbotii* King, *Helichrysum cutchicum* (C. B. Cl.) Rolla Rao et Deshpande, *Manisuris divergens* (Hack.) O. Ktze., *Oianthus deccanensis* Talb., *O. urceolatus* (Dalz.) Benth., *Rotala ritchiei* (C. B. Cl.) Koehne, *Senecio hewrensis* (Dalz.) Hook. f. and *Schizachyrium paranjpyeanum* (Bhide) Raiz, et Jain to mention a few. A few of the species hitherto considered rare proved to be quite common, the apparent rarity being due to the confusion in identity as in the case of *Aristida stocksii*, *Dimeria hohenackeri* and *Capparis cleghornii*. A few species as *Ceropegia fantastica* Sedgw., *C. lawii* Hook. f. and *Hypoestis lanata* Dalz. are indeed quite rare and have been successfully re-collected hardly once with great difficulty and hence could be classified as endangered species. In spite of special efforts a few species, some of which were only very recently described, could not be re-collected even from the type localities. These include *Achyranthes coynei* Sant., *Barleria gibsonioides* Blatt., *B. sepulosa* C. B. Cl., *Bothriochloa woodrowii* (Hook. f.) A. Camus, *B. ensiformis* (Hook. f.) Henr., *Lepidagathis handraensis* Blatt., *Cardanthera anomala* Blatt., *Ceropegia odorata* Hook. f., *Caralluma truncato-coronata* (Sedgw.) Grav. et Mayurn., *Oianthus disciflorus* Hook. f., *Hubbardia heptaneuron* Bor, *Viscum mysor-*

ense Heyne etc. These species are probably on their way to extinction, if not already extinct.

The Sahyadri ranges are quite interesting harbouring many monotypic genera and many endemic species. A few monotypic genera as *Nanothamnus* Thoms., *Frerea* Dalz., *Seshagiria* Ansari et Hem., *Bonnayodes* Blatt. and Hallb., *Bhidea* Stapf, *Pogonachne* Bor, *Triplopogon* Bor, are exclusively confined to Maharashtra and some as *Hubbardia* Bor limited to Karnataka but genera as *Adenoon* Dalz., *Calcanthus* T. Anders ex Benth., *Danthonidium* C. E. Hubb., *Lamprachaenium* Benth., *Limnopus* C. E. Hubb. and *Polyzygus* Dalz. though restricted to peninsular India occur along the Western ghats. Western India is also one of the two main centres of origin of Poaceae with a high concentration of species especially of the tribe Andropogoneae which is also substantiated by Jain (1970, 1972) working on the genera *Arthraxon* P. Beauv. and *Manisuris* L. The studies have also revealed new areas of distribution for many hitherto restricted species. *Aglaia talbotii* Sundararaghavan, so far recorded only from North Kanara is now known to extend upto Thane in the north (Maharashtra). Similarly *Dimeria hohenackeri* Hochst. ex Miq. and *Ischaemum mangaluricum* Stapf, considered restricted to Karnataka and Malabar have been profusely collected from Poona district proper. Many species hitherto regarded as confined to Maharashtra (*Cyathocline lutea* Law ex Wt., *Nanothamnus sericeus* Thoms., *Senecio grahamii* Hook. f., *Smitha purpurea* Hook.) or Kerala (*Diospyros foliosa* Wall., *Buchanania lanceolata* Wt., *Semicarpus auriculata* Bedd., etc.) have been recorded from Shimoga district, Karnataka.

A few species as *Alternanthera paronychioides* St. Hill, *Borreria verticillata* (L.) G. P. W. Meyer, *Dactyliandra welwitschii* Hook. f., *Dignathia hirtella* Stapf, *Juncus maritimus* Lamk., *Lepturus radicans* (Steud.) A. Camus,

Parthenium hysterophorus L., *Premna resinosa* Schau., *Schouwia arabica* (Vahl) A. P. DC., *Synedrella vialis* (L.) A. Gray, *Tephrosia uniflora* Gillett and *Zinnia peruviana* (L.) L. turned out to be new records for India (cf. Appendix II). Of the exotic weeds the rapid spread of *Parthenium hysterophorus* L. in different parts of the country has already assumed alarming proportions, causing dermatitis and posing serious threat to agricultural production while *Schouwia arabica* (Vahl) A. DC., though restricted at present to pockets around Dhond (Maharashtra) is suspected of causing cattle diseases. The studies have incidentally emphasised the urgent need for effective control of the weeds through preventive measures.

II. *Biosystematic studies and monographs*: A biosystematic approach to the revision of the Indian genera of Commelinaceae has been undertaken by R. S. Rao and R. V. Kammathy and many papers have been published on nomenclature, new records, new taxa, distribution and cytological observations. In this revision an attempt has been made to blend classical taxonomy with experimental botany and to analyse as to how far the allied fields could help for a better understanding and interpretation of the taxonomic ambiguities and 'species complexes' that exist in the family. As a result, in India, the family is now known to comprise of 80 species under 10 genera excluding the exotic or cultivated species. These studies have vindicated the splitting up of *Cyanotis sensu lato* into three distinct genera (*viz.* *Cyanotis* D. Don, *Amischophacelus* Rolla Rao et Kammathy and *Belosynapsis* Hassk.), separation of *Murdannia* Royle from *Aneilema* R. Br., resurrection of *Dictyospermum* Wt., creation of a new genus *Tricapalema* Morton and retention of *Aclisia* E. Mey. under *Pollia* Thunb. These studies have also thrown light on the evolutionary trends in progress in *Commelina*, *Cyanotis*,

Murdannia and *Aneilema* and the role of polyploidy and aneuploidy in speciation in these genera. In a few cases the new gene-combinations have successfully been retained by vegetation propagation either through proliferation at nodes or through development of underground bulbs (as in *Murdannia juncooides* Wt. and *Cyanotis arachnoidea* var. *thwaitesii* Rolla Rao et Kammathy) with the result the annuals have turned into perennials. A review of the work done and cytotaxonomic observations have been published by Rao *et al* (1968, 1970).

In the genus *Ceropegia* L., seven new species have been described and one elevated from varietal rank to the status of species. Though all species reveal a uniform diploid complement of $2n=22$ the studies have led to a proper understanding of the "*C. lawii*" and "*C. hirsuta*" complexes. The study is in progress: cytomorphological studies in *Chlorophytum* Ker.-Gawl. besides vindicating the distinct status of *C. glaucoides* Blatt., have hinted at the possibility of *C. acaule* being only a variant of *C. laxum*. In this genus with dibasic numbers of $X=7$ and 8, species with $X=8$ are exclusively diploids ($2n=16$), polyploidy being confined to species with $X=7$.

Revisions of the genera *Bothriochloa* O. Kt. and *Cymbopogon* Spreng. are nearing completion. Revision of *Capparaceae* is also in progress.

REFERENCES

- ARUJA, B. S. Deciduous forests of Belgaum. *Proc. nat. Acad. Sci. India* 328 : 203-208. 1962.
 — Vegetation of Sutgatti, Western Ghats. *Ibid.* 328 : 25-32. 1962.
 ALMEIDA, M. R. Three new grasses from the former Bombay Presidency. *J. Bombay nat. Hist. Soc.* 66 : 510-517. 1969.

- A new species of Gramineae (Poaceae)—*Ischaemum bolei* Alm. sp. nov. from Sawantwadi, Maharashtra. *Indian Forester* 98 : 236-238. 1972.
- A new species of Poaceae from Karnataka. *J. Bombay nat. Hist. Soc.* 72 : 813-814. 1975.
- ANSARI, M. Y. AND R. S. RAO. Grasslands of Gujarat State. *Proc. Second annual sess. Acad. Apri. Sci., Coimbatore.* 97-100. 1961.
- AND — *Iphigenia stellata* Blatt.—its identity and economic importance. *Bull. bot. Surv. India* 15 : 118-122. 1973.
- ARORA, R. K. New plant records from North Kanara. *Bull. bot. Surv. India* 2 : 169-170. 1960.
- Flora of North Kanara (Statistico-Biological notes). *Indian Forester* 86 : 609-616. 1960.
- The Botany of Coorg forests I—General. *Proc. nat. Acad. Sci. India* 30 (B) : 289-305. 1960.
- Successional trends in North Kanara forests. *Trop. Ecol.* 1 : 36-37. 1960.
- The forests of North Kanara I—Scrub. *J. Indian bot. Soc.* 40 : 187-200. 1961.
- The forests of North Kanara District. III—Evergreen type. *Ibid.* 42 : 38-60. 1963.
- The forests of North Kanara District. IV—Successional trends and synthesis of vegetation. *Ibid.* 42 : 629-636. 1963.
- The forests of North Kanara District. II—Deciduous type. *Ibid.* 43 : 75-86. 1964.
- The Botany of Coorg forests II. *Proc. nat. Acad. Sci. India* 34 : 100-112. 1964.
- Ecological notes on the vegetation of Coorg District, Western Ghats. *Indian Forester* 91 : 722-742. 1965.
- The vegetation of South Kanara District, Western Ghats, India I—General features and floristic composition of bioedaphic types. *J. Indian bot. Soc.* 44 : 453-467. 1965.
- On the biological spectrum of North Kanara flora. *Indian Forester* 92 : 85-88. 1966.
- The vegetation of South Kanara District, Western Ghats, India. 2—Xylia mixed type. *J. Indian bot. Soc.* 45 : 127-137. 1966.
- The vegetation of South Kanara District, Western Ghats India 3—Evergreen type. *Ibid.* 45 : 304-316. 1966.
- Vegetation of South Kanara District, Western Ghats, India 4—succession in plant communities. *Ibid.* 46 : 15-24. 1967.
- BALAPURE, K. M. Some additions to our knowledge of the plants of Ramtek (Maharashtra). *J. Bombay nat. Hist. Soc.* 68 : 363-377. 1971.
- BARNES, E. Flowering plants of Billigirirangan Hills. *Ibid.* 44 : 436-459. 1944.
- BHARUCHA, F. R. AND K. A. SHANKARNARAYAN. Studies on the grasslands of the Western Ghats, India. *J. Ecol.* 46 : 681-703.
- BILLORE, K. V. Studies on the vegetation and flora of Thana District, Maharashtra State (Ph.D. thesis submitted to Vikram University, Ujjain). 1972.
- AND K. HEMADRI. Observations on the flora of Harischandragarh, Sahyadri range Maharashtra. *Bull. bot. Surv. India* 11 : 335-346. 1969.
- BIRARI, S. P. AND R. D'CRUZ. A new species of *Pseudanthistiria* (Hack.) Hook. f. from India. *J. Bombay nat. Hist. Soc.* 73 : 192-194. 1976.
- BOLE, P. V. Rev. Fr. Hermenegild Santapau, S. J. *Taxon* 19 : 576-583. 1970.
- CHAVAN, A. R. AND G. M. OZA. The Flora of Pavghadh (Gujarat State, India). *M.S. Univ. Baroda Bot. Mem.* No. 1 : 1-296. 1966.
- CHERIAN, P. J. AND R. D. PATASKAR. Contribution to the Flora of Saptasringi and adjoining hills, Maharashtra. *Bull. bot. Surv. India* 11 : 23-34. 1969.
- AND — Studies on the vegetation of Surgana-Harsul ranges of the Sahyadri, Nasik District, Maharashtra. *Ibid.* 11 : 381-397. 1969.
- DABHADE, G. T. Flora of Ulhasnagar. *M.V.M. Patrika* 1 : 1-12. 1966.
- DANDE, V. P. Studies on the Cyperaceae of Nagpur. 2—The achenes. *J. Indian bot. Soc.* 45 : 375-383. 1966.
- DATAR, R. AND V. D. VARTAK. Taxonomic study of the genera *Lipocarpa* R. Br. and *Bulbostylis* Kunth. from India II. *J. Univ. Poona* 48 : 19-32. 1976.
- DESHPANDE, B. D. AND M. B. DESHPANDE. Flora of Chandmari hillocks, Wardha (Maharashtra). *J. Indian bot. Soc.* 42 : 143-154. 1963.
- FERNANDEZ, R. R. AND A. C. DEY. A new species of *Calamus* from Western Ghats. *Indian Forester* 96 : 223-225. 1970.
- GOVINDU, H. C. AND M. J. THIRUMALACHAR. Grass flora of Mysore. *Coll. Agr. Tech. Bull.* 1 : 1-33. 1952.
- AND — The Cyperaceae of Mysore. *Information Tech. Bull.* 1 : 1-15. 1960.

- GNANASUNDERSINGH, B. AND B. A. RAZI. Polygalaceae of Mysore City. *J. Mysore Univ.* 26B : 172-186. 1973-74.
- HEMADRI, K. New and interesting plant records. *Indian Forester* 94 : 808-811. 1968.
- The Flora of Junnar and surroundings; Poona District (Maharashtra State) (Ph.D. thesis of Poona University). 1970.
- JAIN, S. K. On the vegetation of Konkan in Bombay State. *Proc. Nat. Acad. Sci. India* 29 : 329-345. 1959.
- The Vegetation of Dangs district in Gujarat. *Bull. bot. Surv. India* 5 : 351-361. 1963.
- The vegetation and succession of plant communities in Kutch, Gujarat. *Proc. Symp. Recent Adv. Trop. Ecol.* Varanasi 426-437. 1968.
- The genus *Manisuris* L. (Poaceae) in India. *Bull. bot. Surv. India* 12 : 6-17. 1970.
- The genus *Arthraxon* P. Beauv. (Poaceae) in India. *J. Indian bot. Soc.* 51 : 165-183. 1972.
- AND U. R. DESHPANDE. Further contributions to the Flora of Kutch in Gujarat State. *Bull. bot. Surv. India* 2 : 287-292. 1960.
- AND — Observation on the vegetation of Khandesh (Maharashtra). *Proc. Nat. Acad. Sci. India* 34 (3) : 322-333. 1964.
- AND K. C. KANODIA. Additions to the Flora of Kutch. *Curr. Sci.* 29 (9) : 361-362. 1960.
- JANARDHANAN, K. P. Studies on the Flora and vegetation of Bhimashankar and surroundings, Khed taluka, Poona District, Maharashtra State. (Ph.D. thesis, Poona University). 1966.
- KADAMBRI, K. The evergreen ghat rain-forest, Agumbe Kilandur zone. *Indian Forester* 67 : 184-203. 1941.
- The evergreen ghat rain forest of Tunga and Bhadra river sources, Kadur district I. *Ibid.* 68 : 305-312. 1942.
- The ghat rain forests of Hassan District, Mysore State. *Quart. J. Mysore Forest Dept.* 61-85. 1945.
- Short notes on the evergreen forests of Mysore State. *Symp. Trop. moist evergreen forests*, Dehra Dun. 1-15. 1960.
- KAMMATHY, R. V., A. S. RAO AND R. S. RAO. A contribution towards the Flora of Biligirirangan hills, Mysore State. *Bull. bot. Surv. India* 9 : 206-234. 1967.
- KARNIK, C. R. Studies on the flora and vegetation of Satpura mountains. Ph.D. thesis of Pune University. 1961.
- LADWA, H. R. AND R. M. PATIL. Compositae of Dharwar and its vicinity. *J. Bombay nat. Hist. Soc.* 56 : 68-80. 1961.
- MAHABALE, T. S. AND C. R. KARNIK. Distributional studies of forests in Satpura ranges in Khandesh District and factors governing them. *J. Univ. Bombay* 28 (3) : 59-77. 1960.
- MAHAJAN, S. D. Contribution to the flora of Kolhapur District. Part III—The Flora of Kolhapur city. *J. Shivaji Univ.* 1969.
- AND V. V. DIVAN. Contribution to the flora of Kolhapur District vegetation and forest resources of Radhanagari area. *Ibid.* 1 : 69-76. 1968.
- AND M. B. VAIDYA. The vegetation of grasslands around Kolhapur. Part I. *Ibid.* 2 : 85-88. 1969.
- MALHOTRA, S. K. AND S. MOORTHY. Materials for the flora of Chandrapur District, Maharashtra. *Bull. bot. Surv. India* 13 : 292-318. 1974.
- AND B. M. WADHWA. Studies on the botany of Jamnagar District (Gujarat). *M. V. M. Patrika* 8 : 3-23. 1973.
- NAIK, V. N. Herbarium (An enumeration of Vascular plants). *Botany Dept. Marathwada University*, Aurangabad. 1-77. 1974.
- Key to Anigospemic families and certain genera of Marathwada. Aurangabad. 1-32. 1977.
- NAITHANI, B. D. Studies on the flora of Bandipur reserve forests, Mysore State. *Bull. bot. Surv. India* 8 : 252-263. 1966.
- AND M. B. RAIZADA. New records of some Cyperaceae taxa in India. *Indian Forester* 103 : 411-424. 1977.
- PARABIA, M. H. AND G. L. SHAH. Notes on some interesting Cyperaceae of Gujarat. *J. Bombay nat. Hist. Soc.* 72 : 886-888. 1975.
- PAFEL, R. I. Grasses of Gujarat State. *Indian Forester* 91 (5) : 309-340. 1965.
- Forest flora of Melghat. Dehra Dun. 1-380. 1968.
- PATIL, R. P. The mangroves in Salsette island near Bombay. *Symp. Mangrove Forests*, Calcutta. 44-50. 1957.
- PATIL, R. B. AND R. D'CRUZ. On the abundant occurrence of *Ischaemum mangaluricum* (Hook.)

- Stapf ex Fischer in Maharashtra State. *J. Bombay nat. Hist. Soc.* 69 : 449-50. 1972.
- PRAMELA, S. M. AND B. A. RAZI. The Caesalpiniaceae of Mysore City. *J. Mysore Univ.* 23B : 67-88. 1970.
- PURI, G. S. AND S. K. JAIN. The mangrove vegetation of Western India. *Symp. Mangrove forests.* Calcutta. 51-58. 1957.
- AND — The moist deciduous forests of Poona District. *Proc. nat. Acad. Sci. India* 29 (5) : 254-261. 1959.
- AND — The dry deciduous scrub vegetation of Poona District. *Bull. bot. Surv. India* 2 : 329-334. 1960.
- AND R. M. PATIL. Dry deciduous forests in Poona District. *Ibid.* 2 : 149-167. 1960.
- AND S. D. MAHAJAN. The study of the evergreen vegetation of Mahabaleshwar area. *Ibid.* 2 : 109-137. 1960.
- S. K. JAIN AND U. R. DESHPANDE. Some aspects of the distribution patterns of plants of Kutch flora. *Mem. Indian bot. Soc.* 3 : 22-25. 1960.
- c.s. Flora of Rajasthan. *Rec. bot. Surv. India* 19 (1) : 159. 1964.
- RAGHAVAN, R. S. The Flora of Agumbe and Tirthahalli areas in Shimoga District, Mysore State (Ph.D. thesis of Madras University. 1970).
- AND B. M. WADHWA. Mosses of Agumbe and Hulical ranges. Shimoga District—I. *Bull. bot. Surv. India* 10 : 344-347. 1968.
- AND — Mosses of Agumbe (Shimoga District) II. Key to the species and new records for India. *M. V. M. Patrika* 5 : 28-37. 1970.
- RAGHAVENDRA RAO, R. AND B. A. RAZI. The genus *Euphorbia* in Bangalore. *J. Mysore Univ.* 20B : 17-25. 1966.
- AND — Flowering plants of Chamundi hills (Mysore District, Karnataka). *Ibid.* Sect. B. 26 : 70-117. 1973-74.
- RAMASWAMY, S. V. Some aspects of the vegetation of Ramagiri and its immediate neighbourhood. *Bull. bot. Surv. India* 6 : 7-18. 1964.
- AND B. A. RAZI. The study of vegetation of Savandurga. *Bull. bot. Soc. Bengal* 21 (2) : 87-98. 1967.
- AND — The Flora of Balgalore District. Prasaranga, Univ. Mysore Manasagangotri, Mysore 1-739. 1973.
- RANDERIA, A. J. The Compositae genus *Blumea*, a taxonomic revision. *Blumea* 10 : 176-317. 1960.
- AND H. SANTAPAU. The botanical exploration of the Krishnagiri National Park, Borivli, near Bombay. *J. Bombay nat. Hist. Soc.* 53 : 185-200. 1956.
- RAO, R. S. The Flora of Goa Part I (Ph.D. thesis submitted to Agra University). 1969.
- The Flora of Diu, Daman and Nagarhaveli Part II (Ph.D. thesis submitted to Agra University), 1969.
- Studies on the Flora of Kutch, Gujarat State (India), and their utility in the economic development of the semi arid region. *Ann. Arid Zone* 9 (2) : 125-142. 1970.
- RAO, A. S. AND A. R. K. SASTRY. An account of the flowering plants of Indore District in Madhya Pradesh. *Bull. bot. Surv. India* 6 : 267-286. 1964.
- RAO, R. S. AND K. C. KANODIA. Studies on the vegetation and Flora of Jodhpur division, Rajasthan State. Part I. *Ann. Arid Zone* 1(1) : 16-46. 1962.
- AND — Part II. *Ibid.* 2 (1) : 35-60. 1963.
- AND — Grasses of Mt. Abu, Rajasthan State. *Ibid.* 4 (2) : 110-119. 1965.
- M. Y. ANSARI, V. KAPADIA AND R. SUKHDEV. New sources of colchicine in *Iphigenia*. *J. Phytochem.* 11 : 1193-1194. 1972.
- AND A. R. K. SASTRY. Deciduous forests of Devarayanadurga, Mysore State. *Bull. bot. Surv. India* 6 : 159-167. 1964.
- AND R. S. RAGHAVAN. *Capparis moonii* Wt.—a reinvestigation on the identity and value as a drug *J. Sci. Indus. Res.* 23 : 53-57. 1964.
- R. V. KAMMATHY AND R. S. RAGHAVAN. Cytotaxonomic studies on Indian Commelinaceae : A review. *J. Linn. Soc. (Bot.)* 60 : 357-380. 1968.
- R. S. RAGHAVAN AND R. V. KAMMATHY. Biosystematic studies on Indian Commelinaceae—The chromosome pattern and evolutionary trends. *Bull. bot. Surv. India* 14 : 242-254. 1970.
- RAO, T. A. AND K. R. AGARWAL. Ecological studies of Saurashtra coast and neighbouring islands—I. Diu islands. *Ibid.* 6 : 173-183. 1964; II. Byet island. *Ibid.* 8 : 16-24. 1966.

- , — AND A. K. MUKHERJEE. Ecological studies of Saurashtra coast and neighbouring islands—IV Piram island. *Ibid.* 8 : 60-67. 1966.
- AND B. C. KORLAHALLI. Some interesting plants from the Saurashtra coast. *J. Bombay nat. Hist. Soc.* 64 (3) : 585-586. 1967.
- AND A. K. MUKHERJEE. Ecological studies of Saurashtra coast and neighbouring island —V. Jafarabad to Bhavnagar coastal area. *Bull. bot. Surv. India* 9 : 79-87. 1967.
- AND B. SAFUI. Distribution of some rare plants along Saurashtra coast and its neighbouring islands. *Proc. Indian Acad. Sci.* 58 : 362-366. 1963.
- AND P. G. SHANWARE. Ecological studies of Saurashtra coast and neighbouring islands —VI. An approach to the classification of the Saurashtra West coast land. *Bull. bot. Surv. India* 9 : 240-248. 1967.
- RAZI, B. A. A list of Mysore plants. *J. Mysore Univ.* B7 (4) : 39-81. 1946.
- SABNIS, S. D. Cyperaceae of Gujarat. *Bull. bot. Surv. India* 4 : 193-197. 1962.
- SALDANHA, C. J. The genus *Striga* Lour. in Western India. *Ibid.* 5 : 67-70. 1963.
- The genus *Torenia* Linn. in Western India. *Ibid.* 8 : 126-132. 1966.
- AND DAN H. NICOLSON. Flora of Hassan District, Karnataka, India. New Delhi. 1976.
- SATYANARAYAN, Y. Ecological studies of Bombay coast line Strand vegetation. *J. Bot. Sci.* 1 : 53-55. 1958.
- Ecological studies of the Elephanta island Travaux de la sec. Sci. & Tech. 1 : 99-217. 1959.
- Ecological studies of the evergreen vegetation of the Western Ghats. *Proc. Symp. Humid Trop. Veg. Tjiawi, Indonesia.* 196-211. 1961.
- AND K. A. SHANKARNARAYAN. Vegetation of Bellary district, Mysore State. *Ann. Arid Zone* 2 : 123-149. 1963.
- AND — Vegetation of Bellary district Mysore State. II. Vegetation types. *Ibid.* 3 : 54-62. 1964.
- SHAH, G. L., M. H. PARABIA AND R. G. BHATT. Some interesting rare Cyperaceae of Gujarat as new records for the erstwhile Bombay Presidency. *Indian Forester* 100 : 121-122. 1974.
- SINGH, N. P., S. K. MALHOTRA AND S. K. MUDALIAR. A contribution to the Flora of Kolhapur district. *M. V. M. Patrika* 7 (1 & 2) : 25-43. 1972.
- SUBRAMANYAM, K. N. AND R. S. RAO. Notes on the flora of Pravarasangam area, Maharashtra State. *Bull. bot. Surv. India* 3 : 395-401. 1961.
- THIRUMALACHAR, M. J., K. B. A. KHAN AND B. G. C. SWAMY. Some common flowering plants of Nandi hills. *J. Mysore Univ.* B3 (12) : 73-88. 1942.
- B. A. RAZI AND B. G. L. SWAMY. Contributions to the flora of Nandi hills, Part II. Additions to the common flowering plants of Nandi hills. *Ibid.* B9 (5) : 73-83. 1949.
- VADNYA, B. S. The Flora of Ahmedabad. Ahmedabad. 1967.
- VARTAK, V. D. Importance of nut morphology in classification of sedges. *Proc. Autumn School Botany, Darjeeling.* 334-347. 1966.
- Enumeration of plants from Gomantak, India. *Maharashtra Association for the Cultivation of Science. Poona* 1-169. 1966.
- AND M. BHADSHADE. Family Podostemaceae from Maharashtra and Goa. *J. Univ. Poona* 44 : 181-197. 1973.
- VENKATA REDDY, B. The Flora of Sakarpathar and Ambavane regions of Poona District. *Bull. bot. Surv. India* 11 : 138-149. 1969; 11 : 249-259. 1969; 12 : 213-225. 1970.
- WADHWA, B. M. Additions to the flora of Laccadives, Minicoy and Aminidives groups of islands. *Ibid.* 3 : 407-408. 1961.
- YOGANARASIMHAN, S. N. AND K. SUBRAMANYAM. A new species of *Marsdenia* R. Br. (Asclepiadaceae) from South India. *Proc. Indian Acad. Sci.* 83 B(4) : 147-149. 1976.

* Regarding publications cited but not included, refer History of Botanical Researches in India, Burma and Ceylon by Santapau (1958). As to publications by Santapau and his associates refer Bole (1970).